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ABSTRACT

The employment status of 1981-1982 degree recipients in physics and astronomy was surveyed. Information is presented on changes in occupational status of physics and astronomy degree recipients which occurred between the summer of 1982 and the following winter. The characteristics of graduates of both fields who were employed full-time or undertaking postdoctoral studies are compared in relation to sex, age, citizenship, type of research, and major subfields. Additionally, major subfields of physics dissertations and those of physicists' initial employment are compared. The length of postdoctoral fellowships for 1981-1982 degree recipients is considered in relation to citizenship, selected subfields, and postdoctoral plan. The characteristics of physics masters and bachelors that influence the time required to secure employment and data on employers of new doctoral physicists are provided. Finally, information on the employment of astronomy bachelors is included. Findings include the following: fewer doctoral physicists secured potentially permanent employment within a 2-month period; physics bachelors on the West Coast required less time to secure initial employment than those from other regions; and compared with the previous year, the proportion of graduates who accepted 1-year postdoctoral fellowships increased from 28 to 43 percent. (SW)

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EMPLOYMENT SURVEY 1982

by Susanne D. Ellis AIP Pub. No. R-282-6 October 1983

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EMPLOYMENT SURVEY 1982

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At all three degree levels, doctoral, master's and bachelor's, the goal of a large proportion of the graduates is immediate employment. Two surveys conducted each summer, when a majority of degrees are conferred, allow new graduates to make their post-degree goals known to us. Thus we can single out all employment-oriented graduates for inclusion in the Employment Survey which focuses on detailed descriptions of initial employment for physicists and astronomers. The questions range from how much time was spent in securing employment, to the subfield mobility and work activity involved in employment offers. To assure ourselves of informative responses to the survey from the degree recipients, it is necessary for them to have worked long enough to make useful evaluations. For that reason the Employment Survey is scheduled for December of each year, which assumes that most of the respondents have worked for at least six months. A few respondents will report more than one year's experience because this survey includes the employment-oriented graduates between July 1981 and June 1982.

Highlights of this report are:

- Fewer doctoral physicists secure potentially permanent employment within a two-month period.
- Physics bachelors on the West Coast require less time to secure initial employment than those from other regions of the U.S.
- Compared with the previous year the proportion of graduates who accepted one-year postdoctoral fellowships increased from 28% to 43%.

An important measure, related to the demand for new physics graduates, is how quickly new physicists accept suitable employment. **Figure 1** presents four time-periods during which graduates at each of the three levels accepted employment, but excludes temporary 'postdocs'. Comparing this bar graph with that of the previous year only doctoral physicists recorded changes. For example, in 1981, 46% of

Figure 1. Time spent by 1981–82 physics degree recipients in securing employment

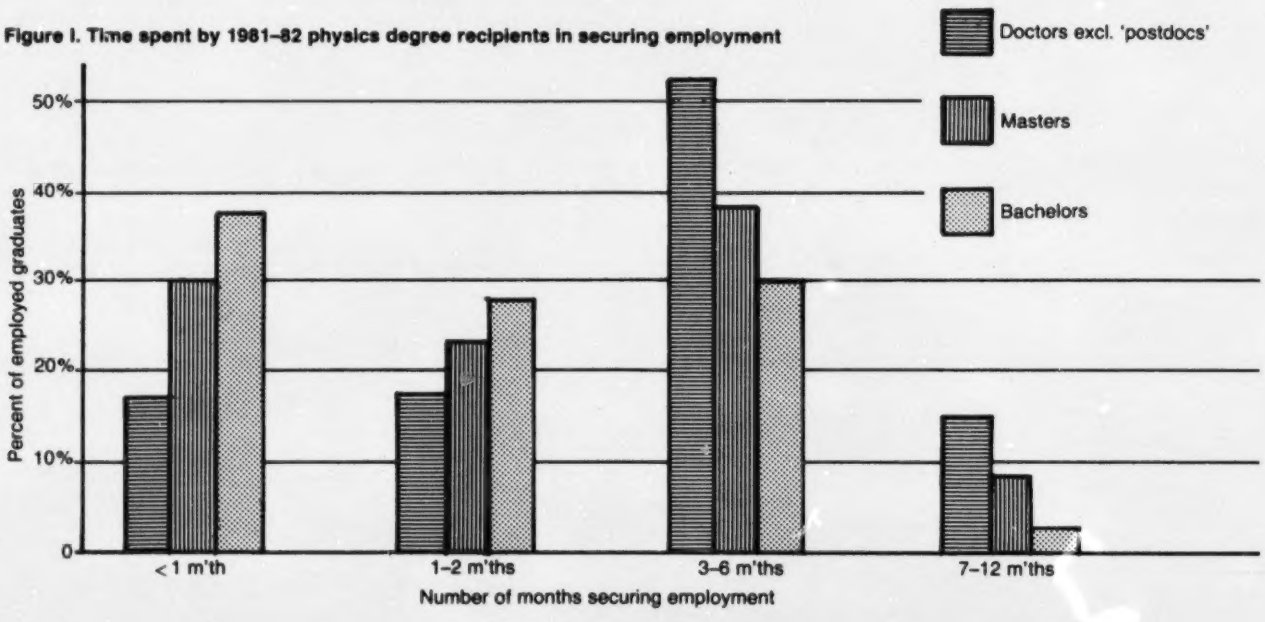

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Table I. Changes in occupational status of physics degree recipients between the summer of 1982 and the following winter.

Employment status reported by physics degree recipients, summer 1982	Occupational status, winter 1982–83						
		'Postdoc' or student	Employed full-time perm.	Employed p-t, temp., other	Not empl. and seeking	Total N	Total %
Doctors							
Newly accepted empl.		7	169	–	–	176	40
Continuing employment		3	30	–	–	33	7
'Postdoc'		168	16	1	–	185	43
Other		5	1	1	4	11	2
Not empl. and seeking		7	21	–	7	35	8
Total respondents	N	190	237	2	11	440	
	%	43	54	–	3		100%
Masters							
Newly accepted empl.		4	76	–	1	81	52
Continuing employment		1	28	1	–	30	19
Career military		–	8	–	–	8	5
Other		3	9	2	3	17	11
Not empl. and seeking		1	12	1	7	21	13
Total respondents	N	9	133	4	11	157	
	%	6	85	2	7		100%
Bachelors							
Newly accepted empl.		2	325	3	4	334	45
Continuing employment		1	113	–	6	120	16
Military service		–	87	–	–	87	12
Volunteer or temp.		7	48	3	12	70	10
Will be seeking empl.		2	9	2	9	22	3
Not empl. and seeking		7	65	2	28	102	14
Total respondents	N	19	647	10	59	735	
	%	3	88	1	8		100%

the doctors required a maximum of two months before accepting employment; in 1982, (see **Figure I**) only 34% fall into that category. On the other hand, the distribution of physics masters and bachelors among the time periods is almost identical to that of the previous year.

The occupational status of recent graduates is likely to fluctuate; hence a follow-up survey conducted after a period of six months has elapsed can present a more realistic employment picture. **Tables I** and **II** focus on physics and astronomy degree recipients respectively analyzing the doctors, masters, and bachelors in each discipline separately. Of special interest in **Tables I** and **II** is the extent to which the numbers of degree recipients who decribed themselves as "not employed and seeking", changed in that six-month period and it appears that those changes are considerable. For example, doctoral physicists reduced their number who sought employment to less than one-third, while masters and bachelors reduced their numbers to approximately one-half.

Table II. Changes in occupational status of astronomy degree recipients between the summer of 1982 and the following winter.

Employment status reported by astronomy degree recipients, summer 1982		Occupational status, winter 1982–83				
Doctors		'Postdoc' or student	Full-time employed	Not employed and seeking	Total N	Total %
Newly accepted empl.		1	6	–	7	16
Continuing employment		–	6	–	6	14
'Postdoc'		26	4	–	30	70
Total respondents	N	27	16	–	43	
	%	63	37	–		100%
Masters						
Newly accepted empl.		1	3	–	4	50
Continuing employment		–	1	1	2	25
Not employed & seeking		–	1	1	2	25
Total respondents	N	1	5	2	8	
	%	12	63	25		100%
Bachelors						
Newly accepted empl.		–	14	–	14	47
Cont., incl. military		–	3	–	3	10
Temporary employment		–	2	–	2	6
Not employed & seeking		–	10	1	11	37
Total respondents	N	–	29	1	30	
	%	–	97	3		100%

Doctoral physicists and astronomers

When analyzing the occupational status of physicists it is meaningful to distinguish between experimentalists and theoreticians, because degree recipients whose dissertations were based on experimental work are more likely to be offered potentially permanent positions. Theoreticians, on the other hand, are more likely candidates for 'postdocs.' **Table III** presents such an analysis and shows that only 42% of the theoreticians secured potentially permanent employment whereas 58% of the experimentalists did so.

Table III. Occupational status of experimental and theoretical physicists by type of dissertation research, 1982–83*.

Occupational status	Experimentalists	Theoreticians	Total N	Total %
Full-time empl.	58%	42%	203	53
'Postdoc'	38	54	164	43
Other	2	–	7	2
Unempl. & seeking	2	4	9	2
	100%	100%		
Total N	269	114	383	
Total %	70	30		100%

**57 Doctors did not specify type of research.*

Table IV. Characteristics of postdoctoral and full-time employed physics and astronomy doctorate recipients, 1981–82.

Physics			Astronomy		
Characteristics	'Postdocs'	Full-time employed	'Postdocs'	Full-time employed	Characteristics
Sex					Sex
Female	8%	5%	7%	19%	Female
Male	92	95	93	81	Male
Age					Age
26 or younger	6%	5%	–	–	26 or younger
27 yrs.	15	11	19%	–	27 yrs.
28 yrs.	22	21	41	13%	28 yrs.
29 yrs.	16	17	4	19	29 yrs.
30 yrs.	15	12	11	31	30 yrs.
31–32 yrs.	14	14	15	25	31–32 yrs.
33 or older	12	20	10	12	33 or older
Citizenship					Citizenship
U.S.	72%	86%	85%	100%	U.S.
Foreign	28	14	15	–	Foreign
Type of research					Type of research
Experimental	67%	76%	74%	87%	Observational
Theoretical	33	24	26	13	Theoretical
Major subfields of dissertation					Major subfields of dissertation
Astrophysics	7%	3%	15%	–	Astrophysics
Electron, atomic & molec.	7	13	48	33%	Cosmology, extragalactic, quasi-stellar objects
Elem. particles	19	6	–	13	Galactic structure, stellar motions
Math. physics	3	5	18	27	Stellar atmospheres & spectra, stellar evolution,
Nuclear	8	8	15	7	solar & stellar interiors
Plasma, fluids	4	10	4	7	Interstellar matter & gaseous nebulae
Solid state	39	34	–	13	Supernovae, x,γ, and cosmic rays, pulsar
				Other	
Number of respondents	190	237	27	16	

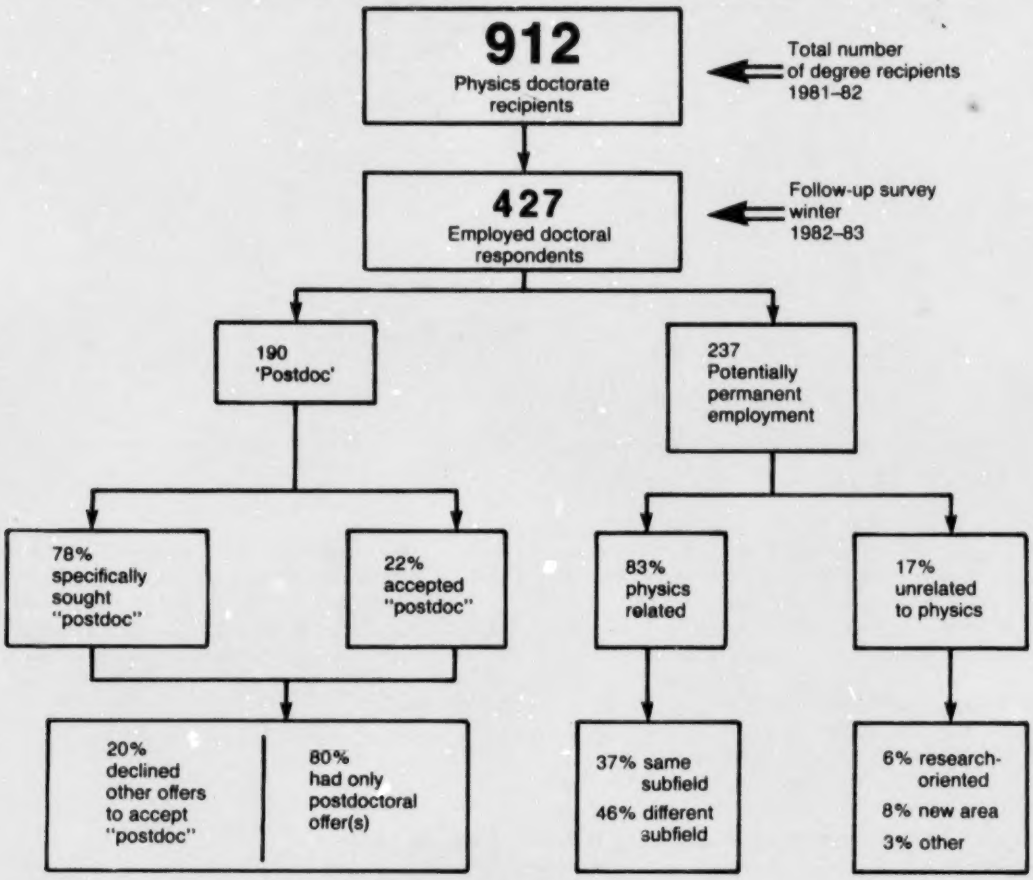
A further analysis of postdoctoral versus potentially permanent employment is presented in **Table IV** which compares the initial employment of physicists and astronomers. For example, more physicists accepted potentially permanent positions than temporary postdoctoral fellowships, whereas the reverse is true for new astronomers. To determine which characteristics are associated with the initial employment of those scientists we examine five characteristics in **Table IV** and find that age, citizenship and type of research appear consistantly influential. For example, doctorate recipients who accepted 'postdocs' are younger, include more foreign citizens and tend to be theoreticians. In regard to physics subfields elementary particle physicists are more likely to accept 'postdocs', while plasma physicists tend to accept permanent positions.

The ratio of doctorates conferred on physicists to those conferred on astronomers is approximately ten-to-one, and the respondents from these groups form the same ratio. The questions directed at these two groups of graduates are similar, which account for the parallel analyses presented in **Tables I, II** and **IV**. However, a further examination of the characteristics is no longer meaningful for so small a group as the astronomers comprise. Thus **Figure II** includes only physicists, and explores further the difference between 'postdocs' and those with potentially permanent employment.

For example, postdoctoral fellowships are temporary and low-paying, but to many graduates these drawbacks are offset by an opportunity to continue the research of their dissertations. For that reason **Figure II** indicates what proportion of new postdoctoral physicists specifically sought postdoctoral fellowships. It is 78% for the 1982 graduates, down five percentage points from the previous year.

Appropriate questions for physicists who had accepted permanent positions concern the type of work and their attitudes toward changing subfields. **Figure II** distinguishes between respondents who describe their work as "related" or "unrelated" to physics, a ratio which remained almost constant in recent years. But the majority of those who accepted physics-related employment does not work in the subfield of the dissertations. In fact the 37% noted in **Figure II** who remain in the same subfield, represents a decline from 43% in the previous year, and from 50% in the year before that.

Figure II. Employment status of 1981–82 doctoral physicists 6–18 months after graduation.



Continuing the comparison between 'postdocs' and graduates with potentially permanent positions, **Table V** focuses on the subfield mobility experienced by each group. The table lists five major dissertation subfields for each group and matches them against the subfields associated with the physicists' initial employment. Thus it clearly shows the degree to which postdoctoral fellowships are offered in the same subfield. Potentially permanent employment on the other hand, frequently crosses subfields. For example, only one-quarter of the electron, atomic and molecular physicists work in their subfield while most of the rest work in optics, plasma physics, solid state, education and other applied disciplines.

Table V. Subfield mobility of doctoral level physicists, 1981–82.

	Subfields of 'postdoc'								
Major subfields of dissertations	Elementary particles	Nuclear	Electron, atomic & molecular	Solid state	Astrophysics	Medical physics	Plasma	Other	Total respondents
Elem. particles	**94%**	3%	–	–	–	–	–	3%	36%
Nuclear	6	**82**	6%	–	–	6%	–	–	17
Electron, atomic & molec.	–	–	**59**	12%	6%	–	6%	17	17
Solid state	–	–	2	**92**	–	2	2	2	68
Astrophysics	–	–	–	–	**90**	–	–	10	10
									148

	Subfields of potentially permanent employment									
Major subfields of dissertations	Nuclear	Electron, atomic & molecular	Optics	Plasma, fluids	Solid state	Applied	Geophysics, atmosph. phys.	Education	Other	Total respondents
Nuclear	**27%**	–	7%	–	–	20%	13%	–	33%	15
Electron, atomic & molec.	–	**24%**	12	12%	12%	16	8	12%	4	25
Optics	–	–	**53**	8	8	–	23	8	–	13
Plasma, fluids	–	5	–	**57**	5	23	–	10	–	21
Solid state	–	2	12	–	**49**	15	10	7	5	59
										133

Table VI. Factors influencing the length of postdoctoral fellowships for 1981–82 doctoral level physicists.

Characteristics			Length of 'postdoc' <1 yr.	1.5 to 2 yrs.	>2 yrs.	Total reporting %	N
Citizenship	U.S.		37%	54%	9%	100%	137
	Foreign		58	41	1	100	53
Selected subfields of Ph.D	Astrophysics		18%	64%	18%	100%	11
	Elem. particles		39	49	12	100	31
	Nuclear		55	36	9	100	11
	Solid State		35	58	7	100	60
Plan	Specifically sought 'postdoc'	Yes	39%	51%	10%	100%	148
		No	53	44	3	100	42
Total respondents		N	82	97	11		190
		%	43	51	6	100%	

The distribution of postdoctoral respondents shown in **Table VI** is considerably different from that of prior years. For a decade through 1981 'postdocs' were offered for increasingly longer periods of time. But in 1982 almost half of the fellowships offered (43%) were for one year or less; only 28% of the 1981 fellowships fell into that time span. Similarly the fraction of two-year fellowships dropped from 60% to 51%, and those offered for longer periods than two years constituted only 6% instead of the previous year's 12%.

Relating the lengths of physics fellowships to three characteristics of their recipients, we note in **Table VI** that (1) foreign degree recipients are more likely to be offered shorter 'postdocs', (2) that fellowships of longer duration are offered to those who specifically seek 'postdocs', and (3) subfields appear to have a variable influence on the lengths of fellowships.

Table VII. Employment with potential permanence accepted by 1981–82 doctorate recipients.

		Univ.	4-yr. coll.	Type of employer Industry	Gov't	FFRC	Other	Total N	Total %
Subfield of Ph.D	Cross disciplinary	4	3	5	1	2	1	16	7
	Elec., atomic, molec.	4	2	20	2	1	2	31	13
	Elem. particles	4	1	6	–	2	3	16	7
	Nuclear	2	1	11	–	3	1	18	6
	Optics	1	–	8	4	–	1	14	6
	Plasma	5	–	9	1	4	–	19	8
	Solid state	14	4	46	12	3	2	81	34
	Other	10	5	19	3	2	3	42	18
Work activity	Teaching	5	9	–	–	–	2	16	7
	Research	13	–	19	6	8	4	50	21
	Teaching & research	21	7	–	–	–	3	31	13
	Res./dev./design	4	–	86	15	7	2	114	48
	Computer science	1	–	7	–	2	–	10	4
	Other	–	–	12	2	–	2	16	7
Physics related work	Same subfield	29	7	29	8	9	6	88	37
	Different subfield	15	9	64	11	5	6	110	46
Unrelated to Physics	Research-oriented	–	–	10	1	3	–	14	6
	New area	–	–	17	1	–	–	18	7
	Other	–	–	4	2	–	1	7	3
Interested in a job change	Yes	14	7	28	4	4	4	61	26
	No	26	7	83	13	10	9	148	62
	Unsure	4	2	13	6	3	–	28	12
Total respondents	N	44	16	124	23	17	13	237	
	%	19	7	52	10	7	5		100%

Turning our attention to the new doctoral physicists who had accepted employment with potential permanence, **Table VII** presents the distribution of their employers, and shows that industry continues to employ a majority of them. Since most of these new physicists have held their positions anywhere from 6 to 18 months, it seemed appropriate to request an evaluation of their initial employment, and even include a question concerning the desirability of a job change within two years. The data on work activities in **Table VII** indicate two three-percentage-point changes from the previous year; research decreased as the combination of teaching and research increased by that same amount. Another recent change represented by the data in **Table VII**, is a shift toward changing subfields among those who are engaged in physics related work. This shift is approximately 6% and can be attributed to the subfield mobility shown in **Table V**.

New physics masters

To supplement the overall comparison among degree recipients shown in **Figure I**, **Table VIII** focuses only on new masters and examines the possibility that any of six characteristics may influence the "time spent finding employment". The first category of the time scale, "< 1 month", is intended to show what proportion of degree recipients either have jobs lined up at graduation, or continue work with the same employer who frequently had helped to finance the graduate's education. The latter conclusion is supported by the distribution in that category which shows that a majority of graduates are age 29 or older, consequently one can assume these masters have worked before completing their degrees. However, for the remaining three time categories, age, as a characteristic seems to have little or no influence on that time factor. Another characteristic is sex, and that one does appear to be influential because two-thirds of the female masters, compared with only one half of the men secured jobs within a two-month period. It should be noted that the employment-oriented physics masters of the class of 1982 included only 13% women as reported by physics department chairmen. **Table VIII** shows a higher percentage of women thus indicating their "above average" response rate to this Employment Survey.

Whether or not initial employment is physics-related constitutes another characteristic examined in **Table VIII**, but one which has little bearing on the time factor this year. The remaining two characteristics are employers and work activities where only the major ones are shown in **Table VIII**. They include military commitments among the employers and teaching among the work activities, both of which need to be arranged well in advance, thereby increasing the percentages of masters who secured employment in less than one month.

When comparing the characteristics in **Table VIII** with those of the previous year, we had to broaden the employer category "College/university" to "Educational institution" because a few respondents had accepted teaching positions in secondary schools. (It should be noted that checking the distribution of respondents by type of graduate institution against our Survey of Enrollments and Degrees, we find a disproportionately low response from the degree recipients of master's granting institutions; they actually comprise 22% of the terminal masters.)

Table VIII. Characteristics of 1981–82 physics masters that influence the time required to secure employment.

Characteristics		Time spent finding employment					Total	
		< 1 mo.	1–2 mos.	3–6 mos.	7–12 mos.		N	%
Sex	Female	26%	39%	26%	9%	100%	23	17%
	Male	32	19	39	10	100	114	83
Age	23 or younger	–	33%	50%	17%	100%	6	4%
	24 yrs.	19%	31	25	25	100	16	12
	25 yrs.	16	24	52	8	100	25	18
	26 yrs.	20	28	48	4	100	25	18
	27–28 yrs.	24	33	33	10	100	22	16
	29 or older	56	9	28	7	100	43	32
Type of graduate institution	Doctorate-granting	29%	22%	40%	9%	100%	117	85%
	Master's-granting	35	25	25	15	100	20	15
Type of employment	Physics related	30%	22%	38%	10%	100%	107	78%
	unrelated to physics	27	23	33	17	100	30	22
Major employer	Industry	22%	24%	43%	11%	100%	87	64
	Gov't/military	54	12	27	7	100	26	19
	Coll./univ.	30	30	3	5	100	20	15
Major work activity	Teaching	38%	33%	24%	5%	100%	21	15%
	Res., dev. or design	30	24	38	8	100	71	52
	Data analysis	19	15	52	14	100	27	20
Total respondents	N	41	31	52	13		137	
	%	30	23	38	9			100%

Table IX. Characteristics of 1981–82 physics bachelors that influence the time required to secure employment.

Characteristics		Time spent finding employment < 1 mo.	1–2 mos.	3–6 mos.	7–12 mos.	Total N	%
Sex	Female	31%	32%	35%	2%	99	15%
	Male	39	28	29	4	558	85
Age	21 or younger	38%	34%	28%	–	34	5%
	22 years	39	28	28	5%	274	42
	23 years	36	26	36	2	152	23
	24–25 years	35	27	31	7	103	16
	26–29 years	36	38	24	2	56	8
	30 or older	50	26	24	–	38	6
Type of bachelor's institution	Doctorate-granting	38%	27%	31%	4%	305	46%
	Master's-granting	35	31	30	4	84	13
	Bachelor's granting	39	30	29	2	268	41
Type of employment	Physics related	33%	28%	33%	6%	388	59%
	Unrelated to physics	45	29	26	–	269	41
Region of bachelor's institution	Northeast	40%	27%	30%	3%	188	29%
	Southeast	40	24	32	4	123	19
	Midwest	32	29	34	5	140	19
	Southwest & Mountain	40	25	30	5	110	17
	Pacific	37	43	20	–	96	14
Major work activity	Res., dev. or design	30%	32%	33%	5%	178	27%
	Programming	32	31	34	3	175	27
	Quality control	23	35	39	3	74	11
Total respondents	N	250	191	197	19	657	
	%	38	29	30	3		100%

New physics bachelors

When examining the physics bachelors, the characteristics which are expected to influence the time spent in finding employment, change only slightly from those discussed in connection with physics masters. Sex, age and the type of bachelor's institution appear to have little effect on the time required to secure employment; however, **Table IX** shows that utilizing one's physics training or not, does make a difference in the time one spends in seeking a position. Only 60% of the physics bachelors reported working in physics-related jobs but almost half of that group (40%) spent at least three months acquiring that type of work. Of those who accepted work which is not physics-related only one quarter needed to spend three months or longer to secure it.

By dividing the country into five large regions and combining the first two time-categories, the Pacific region stands out as that where one secures employment more rapidly than in any other. The last characteristic shown in **Table IX** lists three major work activities of physics bachelors, none of which appear to be significantly influential in securing immediate employment.

New astronomy bachelors

An estimated 80 astronomy bachelors in the class of 1982 were interested in immediate employment. Responding to two surveys and supplying complete employment information were the 29 bachelors whose data are summarized in **Table X**. More than half of them work in industry, and their median monthly salary of $1550. represents only a small increase over the previous year.

Table X. Employment of 1981–82 astronomy bachelors.

Work activity	Industry	Gov't incl. military	Educational institution	Total N	Median monthly salary
Data analysis	4	5	2	11	
Development or design	3	–	–	3	
Teaching	–	–	2	2	$1550.
Quality control	3	–	–	3	
Other professional	3	2	–	5	
Other	3	2	–	5	
Total responents	16	9	4	29	